

ABSTRACT OF THE DISCLOSURE

A vertical cavity surface emitting laser (VCSEL) includes an indium-based semiconductor alloy substrate, a first mirror stack over the substrate, an active region having a plurality of quantum wells over the first mirror stack, a tunnel junction over the active region, the tunnel junction including a p-doped pseudomorphically strained layer of a compound selected from the group consisting of Al-rich InAlAs, AlAs, Ga-rich InGaAs, GaAs and combinations thereof, and a second mirror stack over the tunnel junction. The pseudomorphically strained layer can be used to form a tunnel junction with a n-doped layer of InP or AlInAs, or with a lower bandgap material such as AlInGaAs or InGaAsP. Such tunnel junctions are especially useful for a long wavelength VCSEL.